

# PIKE COUNTY GROUNDWATER-LEVEL OBSERVATION NETWORK 2018

U.S. Geological Survey  
in cooperation with  
the  
Pike County Conservation District  
October 18, 2018

# PURPOSE AND SCOPE - PIKE COUNTY GROUNDWATER-LEVEL OBSERVATION NETWORK

Establish county-wide network of wells to monitor groundwater levels on a monthly basis

Data can be used to assess effects of seasonal climactic, and water-use changes on groundwater levels



Unused well in Pike County network

# Characteristics of aquifers in Pike County

- Fractured-rock aquifers – areally extensive, recharge may be reduced by low-permeability soils or thin glacial cover
- Glacial aquifers – limited areal extent, high-recharge rates in ice-contact units, outwash near Delaware River

# Use of Groundwater Resources in Pike County

- Groundwater is main source of drinking water supply  
(Pike County has continued to grow since 1980s – population increased about 65 percent from 1990 to 2000, ranked 36<sup>th</sup> fastest growing county in nation)
- Groundwater supplies streams

# Sedimentary fractured-rock aquifers



**Raymondskill  
Falls**

**Groundwater  
discharge forms  
base flow in  
streams**

# Pike County groundwater-level observation network, 2007-2018

- 20 wells in network throughout county
- Wells completed in different geologic units
- Wells in most main watersheds
- Levels measured monthly by PCCD, reviewed by USGS and entered into USGS databases
- Network continued in cooperation with PCCD from summer 2007 through 2018 (11 years), with planned extension to 2022 (15 years)

# Pike County groundwater-level observation network applications

- Monitor annual and seasonal range of water level fluctuations
- Long-term data can be used for establishing and monitoring drought conditions
- Useful in determining water budgets for watersheds and estimating stream base-flow conditions

# Network Limitations

**Spatial** - wells not located in some areas of the county; lost some wells from network

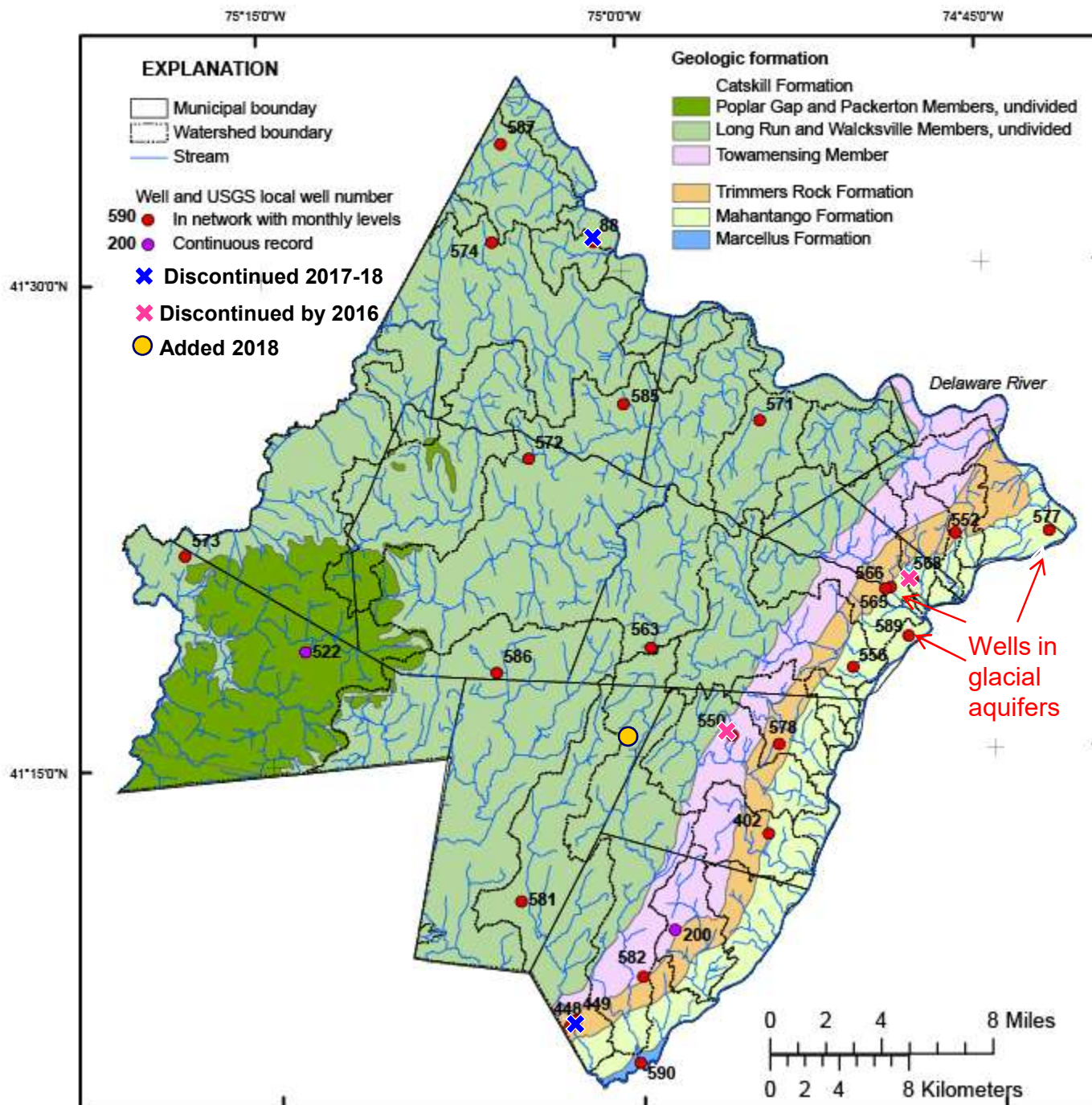
**Temporal** – relatively short period of record (11 years) not representative of full range of hydrologic conditions;

monthly measurements – time-scale resolution

# PIKE COUNTY GROUNDWATER- LEVEL OBSERVATION NETWORK

**2007-17**  
**22 WELLS**  
**MONTHLY LEVELS**  
**SINCE JUNE 2007**  
**AND CONTINUOUS**  
**LEVELS 2 WELLS**  
**(2018 monthly**  
**network has 20**  
**wells as 3 wells**  
**discontinued 2017-**  
**18; 1 well added**  
**2018)**

**WELLS LOCATED**  
**IN BEDROCK AND**  
**GLACIAL**  
**AQUIFERS**



# Network well characteristics – geology and depth

Description of wells with monthly and continuous water levels in Pike County, 2007-2018, and September 2018 water levels

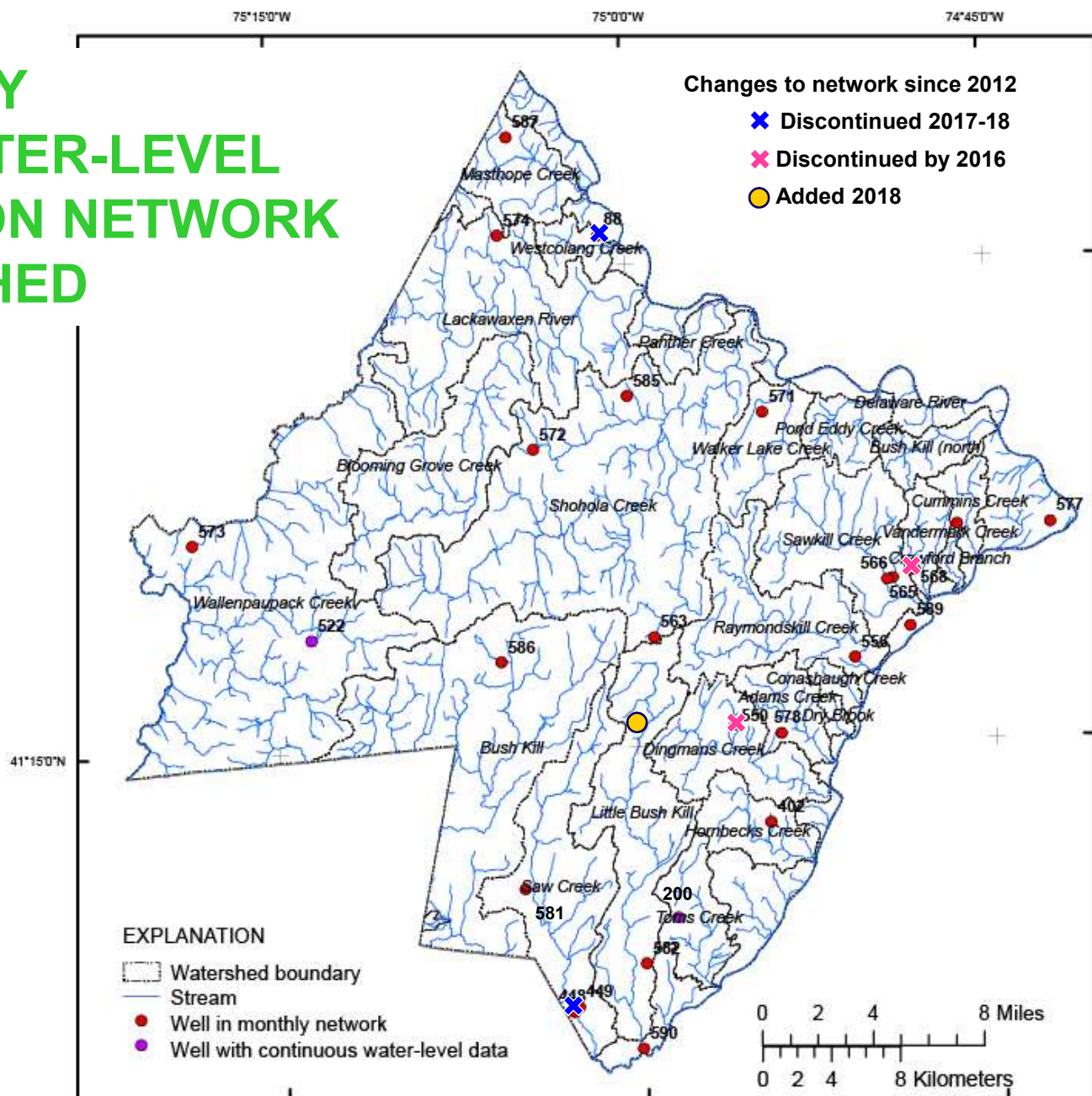
USGS Well name	Depth to water (feet)	Date of water level	Well Depth (feet)	Local Aquifer <sup>1</sup>	Watershed
PI 565	73.69	9/20/2018	154.5	Ice-contact Deposits	Sawkill Creek
PI 566	30.07	9/20/2018	155.5	Ice-contact Deposits	Sawkill Creek
PI 589	99.45	9/20/2018	101	Kame Terrace Deposits	near Delaware River (not state designated)
PI 577	15.06	9/20/2018	24	Outwash	near Delaware River (not state designated)
PI 448	22.19	2/16/2018	72	Till	Saw Creek
PI 522	27.99	9/30/2018	150	Catskill (Poplar Gap Member)	Wallenpaupack Creek
PI 563	16.8	9/21/2018	--	Catskill (Long Run Member)	Shohola Creek
PI 571	84.25	9/20/2018	480	Catskill (Long Run Member)	Walker Lake Creek (Twin Lakes)
PI 572	33.68	9/21/2018	--	Catskill (Long Run Member)	Shohola Creek
PI 573	85.19	9/21/2018	--	Catskill (Long Run Member)	Wallenpaupack Creek
PI 574	55.39	9/20/2018	200	Catskill (Long Run Member)	Lackawaxen River
PI 581	147.78	9/21/2018	270	Catskill (Long Run Member)	Saw Creek
PI 585	28.32	9/20/2018	220	Catskill (Long Run Member)	Shohola Creek
PI 586	26.05	9/21/2018	325	Catskill (Long Run Member)	Bushkill Creek
PI 587	54.18	9/20/2018	--	Catskill (Long Run Member)	Masthope Creek
PI 88	29.4	10/17/2017	748	Catskill (Long Run Member)	West Colang Creek (not state designated)
PI 582	44.28	9/21/2018	725	Towamensing Member (Catskill)	Little Bushkill Creek
PI 200	59.3	8/31/2018	799	Trimmers Rock Formation	Toms Creek
PI 449	17.3	2/16/2018	500	Trimmers Rock Formation	Saw Creek
PI 552	58.41	9/20/2018	--	Trimmers Rock Formation	Cummins Creek
PI 578	70.6	9/21/2018	225	Trimmers Rock Formation	Adams Creek
PI 402	4.64	9/21/2018	825	Mahantango Formation	Hornbecks Creek
PI 556	31.09	9/20/2018	400	Mahantango Formation	Raymondskill Creek
PI 590	26.22	9/21/2018	350	Marcellus Shale	near Delaware River (not state designated)

<sup>1</sup> Catskill Formation names abbreviated for 1) Poplar Gap and Packerton Member and 2) Long Run, Beaverdam Run, Walckville Members, Undivided

[gray shading indicates wells discontinued from network 2017-18]

[yellow shading indicates wells with continuous water levels operated by U.S. Geological Survey (USGS)]

# PIKE COUNTY GROUNDWATER-LEVEL OBSERVATION NETWORK BY WATERSHED



# Network well characteristics – watershed & water level

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# *Pike County groundwater-level observation network, 2007-2012*

- Water levels range from 1 to 148 ft below land surface median level ~40 ft
- Annual fluctuation (WY2008-WY2011) ~1 to 38 ft, median ~7 ft (fluctuation does not appear related to well depth or depth to water)
- Period of record (June 2007 – Sept 2012) is relatively wet – near average or above average annual precipitation

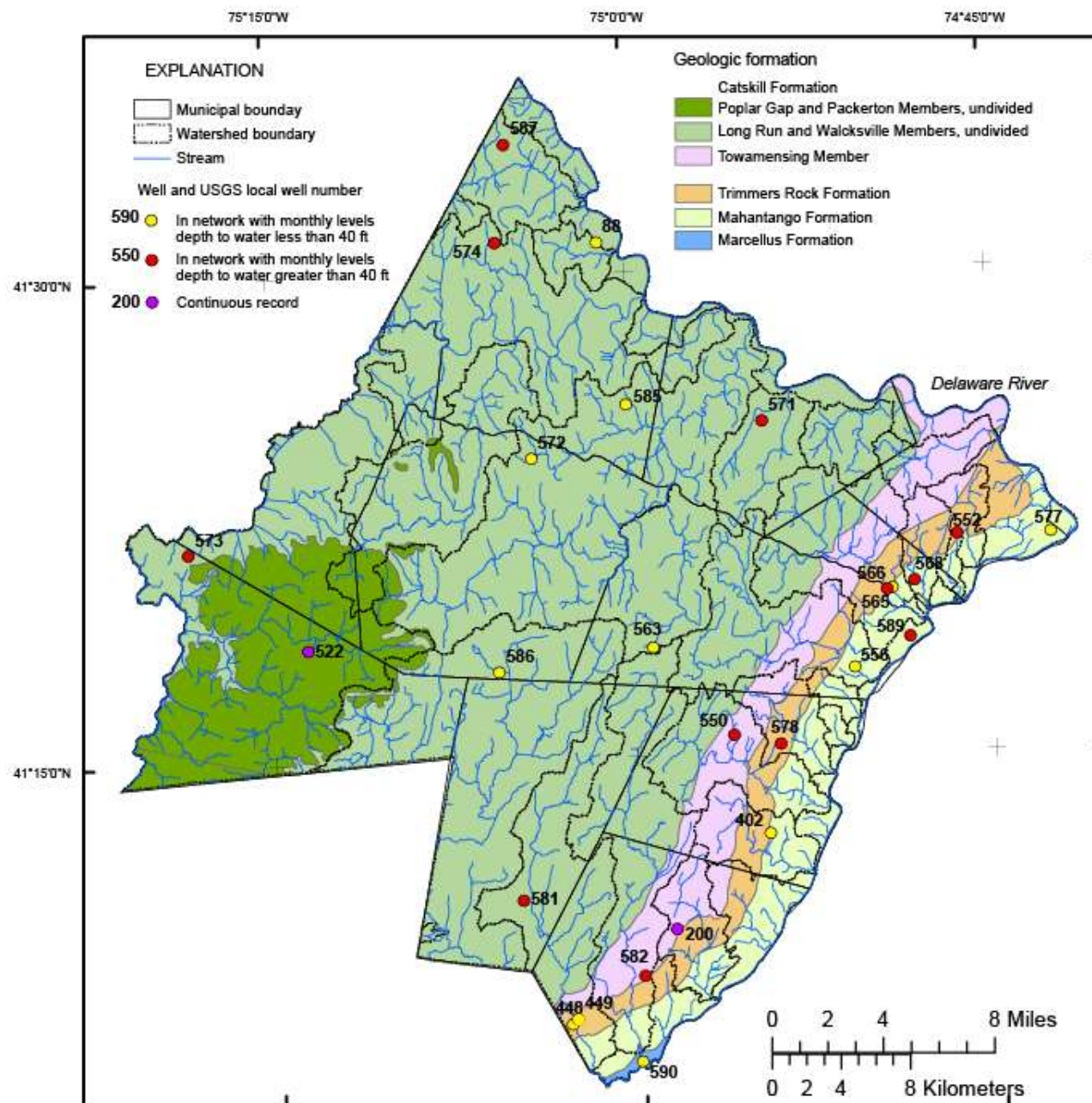
WY08 (72<sup>nd</sup> percentile of 100-year record at Bushkill Creek at Shoemakers, Pa.)  
WY09 (94<sup>th</sup> percentile); WY10 (49<sup>th</sup> percentile); WY11 (98<sup>th</sup> percentile)

Depth to water:  
Median 40 ft

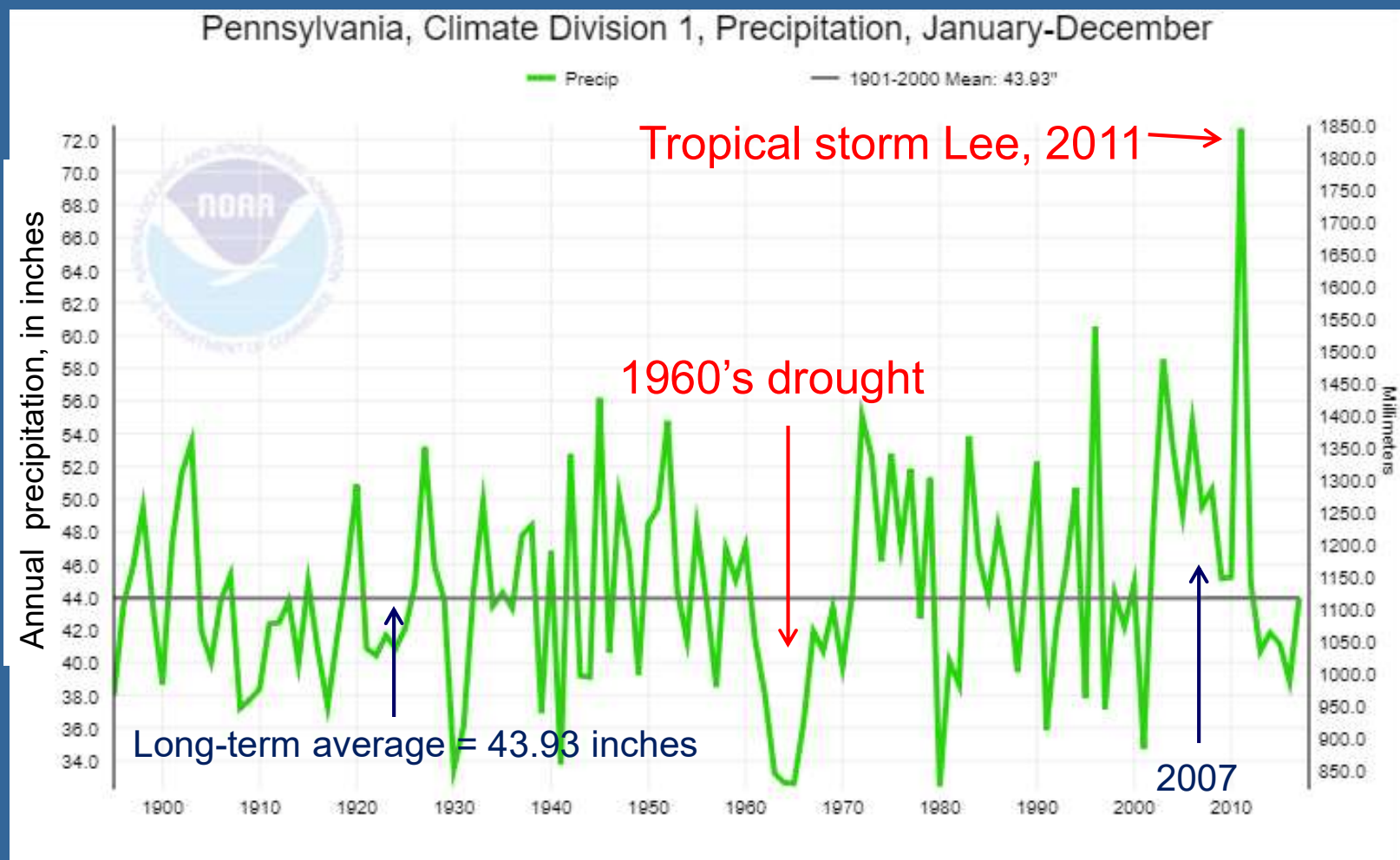
● < 40 ft

● >40 ft

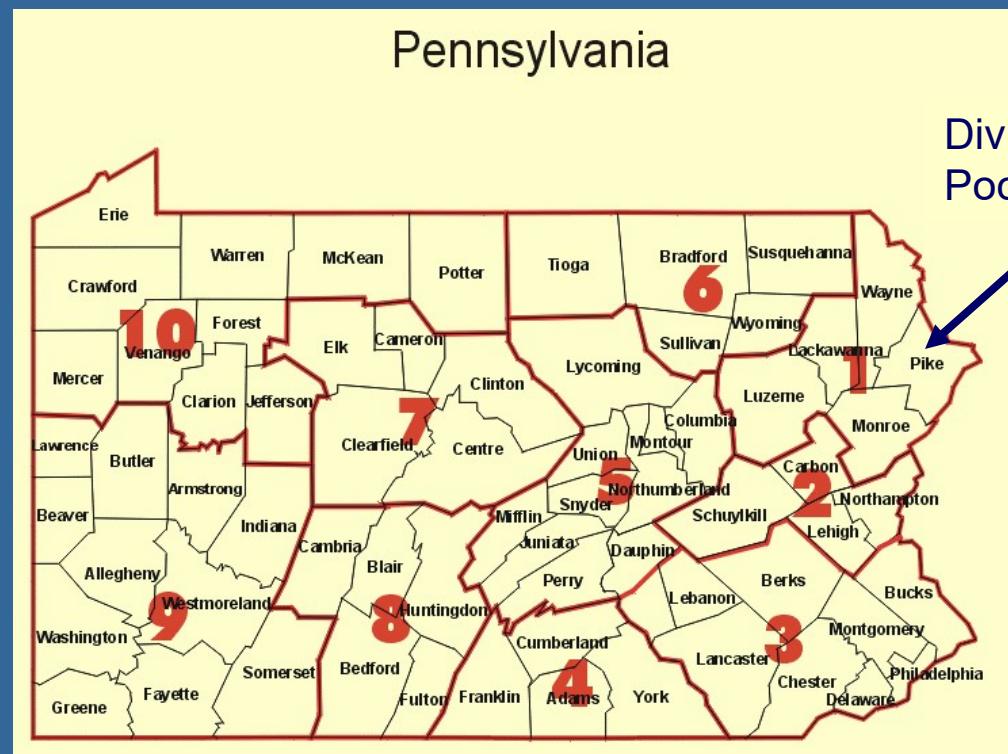
More wells with  
levels < 40 ft  
in uplands



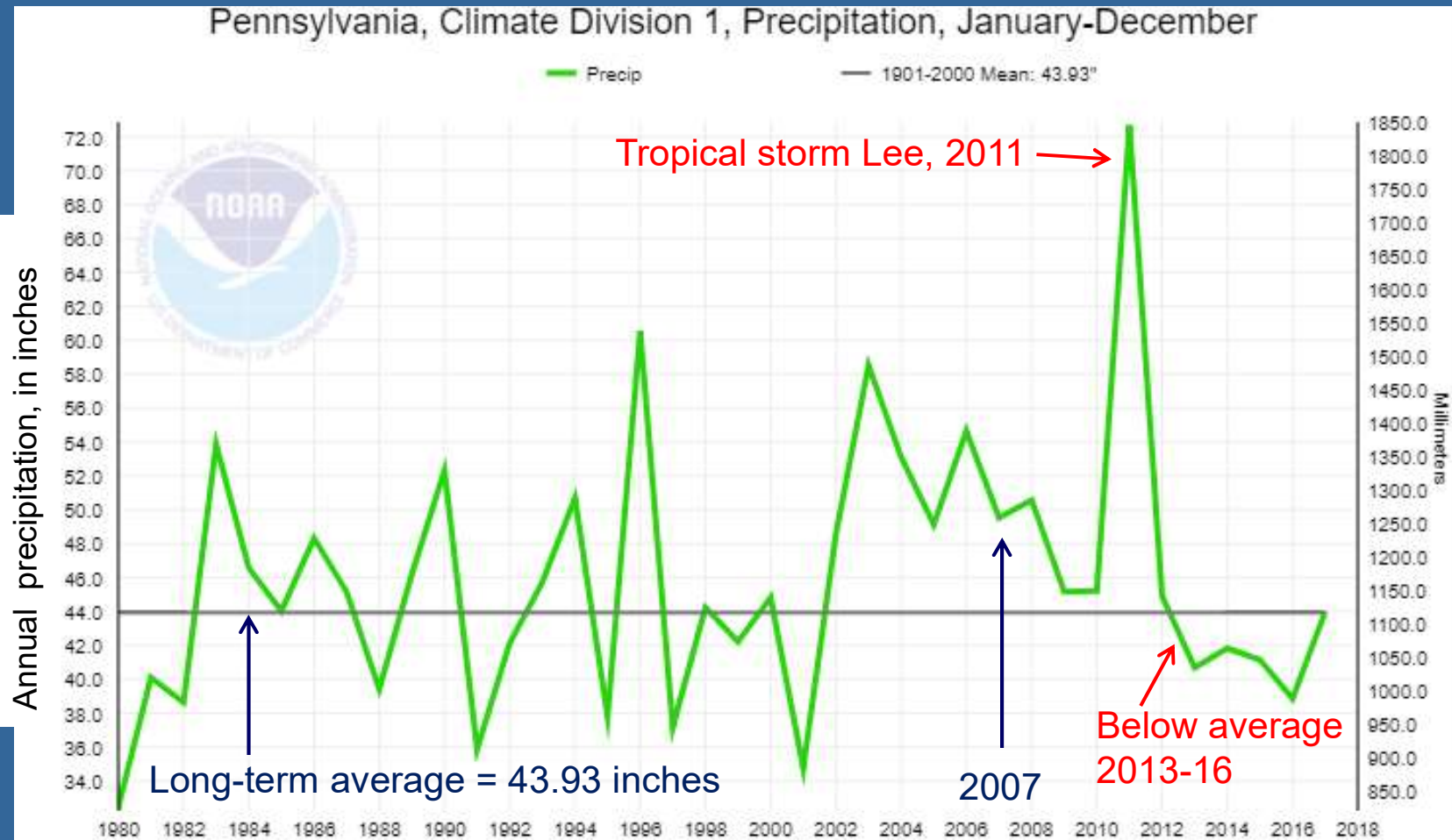
# Annual precipitation, Pocono Mountain area, 1895-2018



## Precipitation Data from NOAA National Climactic Data Center



# Annual precipitation, Pocono Mountain area, 1980-2018



For period of Pike County groundwater-level network 2007-18:  
annual precipitation was above long-term average 2007-12;  
annual precipitation was below long-term average 2013-16.

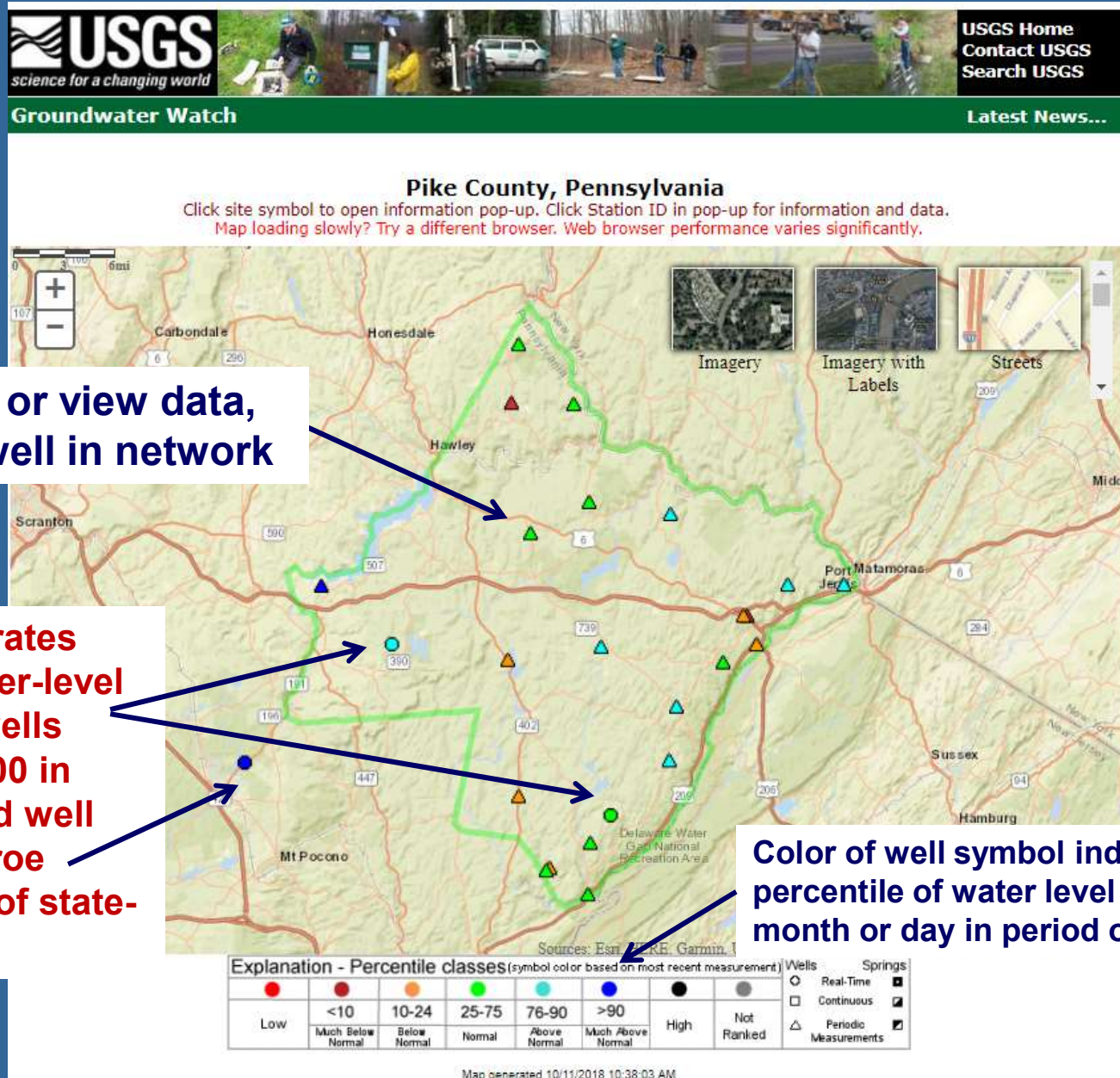
# Pike County groundwater-level observation network, 2007-2015

- Period of record (Oct 2012 – Sept 2015) is normal to slightly drier than normal – near average or below average annual precipitation
- New winter-time groundwater-level lows (2014-2015) observed for most wells on eastern side of county
- Drought recognized by PADEP in winter-spring 2015

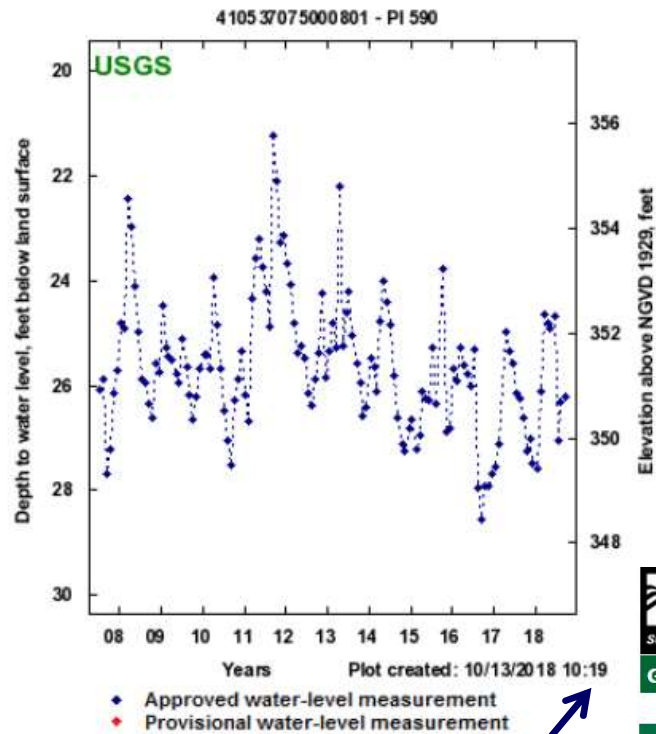
# Notes on Pike County groundwater-level observation network, 2007-2018

- During period of below average annual precipitation (2013-16), new water level lows for period of record 2007-18 observed in several wells in 2016
- Water levels were low (less than 10<sup>th</sup> percentile) in January and July 2018 in numerous wells
- Trends in water levels (2007-18) indicated for a few wells

# USGS web interface for ground-water levels



## Periodic Groundwater Data



### Summary for Period of Record Periodic Water Levels

Depth to water level, feet below land surface

#### Approved Periodic Water Level Values

Begin Date	End Date	Number of Values
------------	----------	------------------

07/10/07	09/21/18	133
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Highest WL	Date of Highest WL	Lowest WL	Date of Lowest WL
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21.24	09/12/11	28.54	09/12/16
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#### Groundwater Levels Options



View latest data on NWISWeb



Download groundwater levels in text format



Groundwater Watch

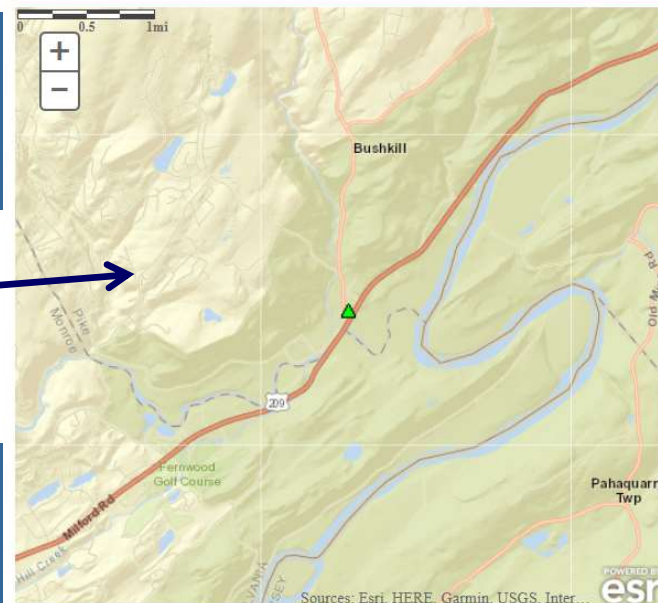
USGS Home  
Contact USGS  
Search USGS

Latest News...

Data – plot and links

Map location and other information about observation well

Site Number: 410537075000801 - PI 590



#### DESCRIPTION:

Latitude 41°05'37.1", Longitude 75°00'08.0" NAD83  
Pike County, Pennsylvania, Hydrologic Unit 02040104  
Well depth: 350 feet  
Hole depth: 350 feet  
Land surface altitude: 377feet above NGVD29.  
Well completed in "Other aquifers" (N9999OTHER) national aquifer.  
Well completed in "Marcellus Shale" (344MRCL) local aquifer

#### AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Field groundwater-level measurements	2007-07-10	2018-02-16	126
Revisions	Loading...		

Additional Data Sources	Begin Date	End Date	Count
Groundwater Watch **offsite**	2007	2018	126
Annual Water-Data Report (pdf) **offsite**	2007	2011	5

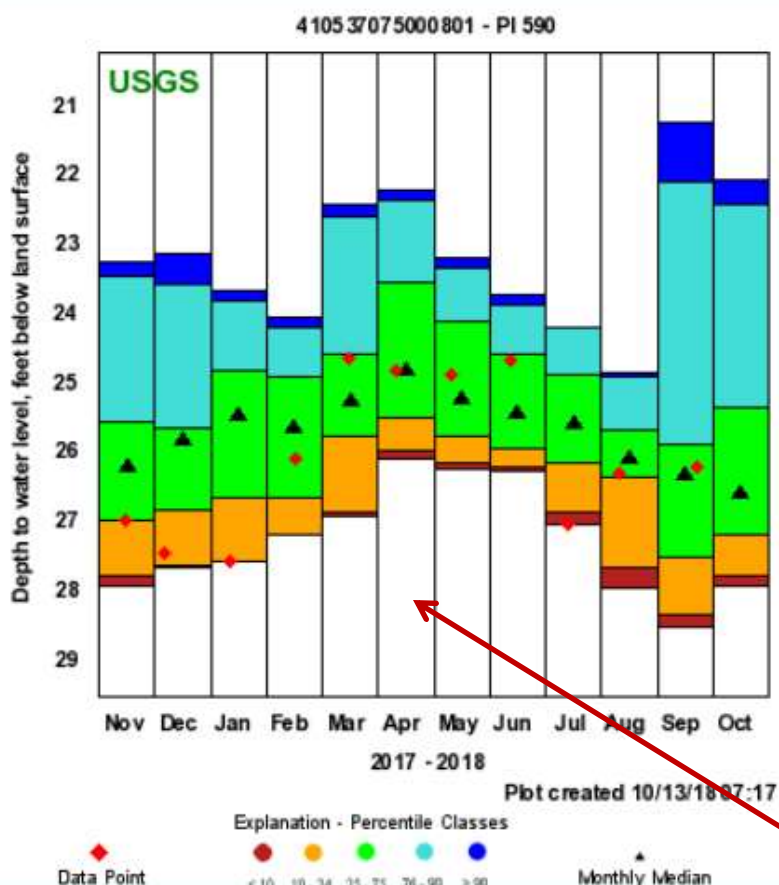
#### OPERATION:

Record for this site is maintained by the USGS Pennsylvania Water Science Center  
Email questions about this site to Pennsylvania Water Science Center Water-Data Inquiries

# Seasonal fluctuations in groundwater levels– typically highest levels in April/May, lowest in September/October

## Water-level statistics

Site Statistics



Most recent data value: **26.22** on 9/21/2018  
 Period of Record Monthly Statistics for 410537075000801  
 Depth to water level, feet below land surface  
 All Approved Continuous & Periodic Data Used In Analysis  
 Note: **Highlighted** values in the table indicate closest statistic to the most recent data value.

Month	Lowest	10th	25th	50th	75th	90th	Highest	Number of Years
	Median	%ile	%ile	%ile	%ile	%ile	Median	
Jan	27.59	27.58	26.66	25.47	24.82	23.83	23.67	11
Feb	27.21	27.19	26.68	25.66	24.91	24.21	24.06	11
Mar	26.94	26.86	25.79	25.27	24.58	22.62	22.43	10
Apr	26.10	26.00	25.50	24.82	23.57	22.36	22.21	11
May	26.26	26.17	25.78	25.25	24.11	23.35	23.19	11
Jun	26.29	26.23	25.95	25.46	24.60	23.87	23.74	11
Jul	27.04	26.87	26.15	25.59	24.90	24.22	24.22	12
Aug	27.96	27.68	26.37	26.10	25.70	24.92	24.87	12
Sep	28.54	28.37	27.52	<b>26.34</b>	<b>25.89</b>	22.10	21.24	11
Oct	27.93	27.80	27.21	26.62	25.36	22.42	22.08	11
Nov	27.93	27.79	27.00	26.21	25.56	23.46	23.26	11
Dec	27.67	27.63	26.83	25.85	25.67	23.58	23.14	11

.As of 10/12/2018 23:19-2



Statistics Options

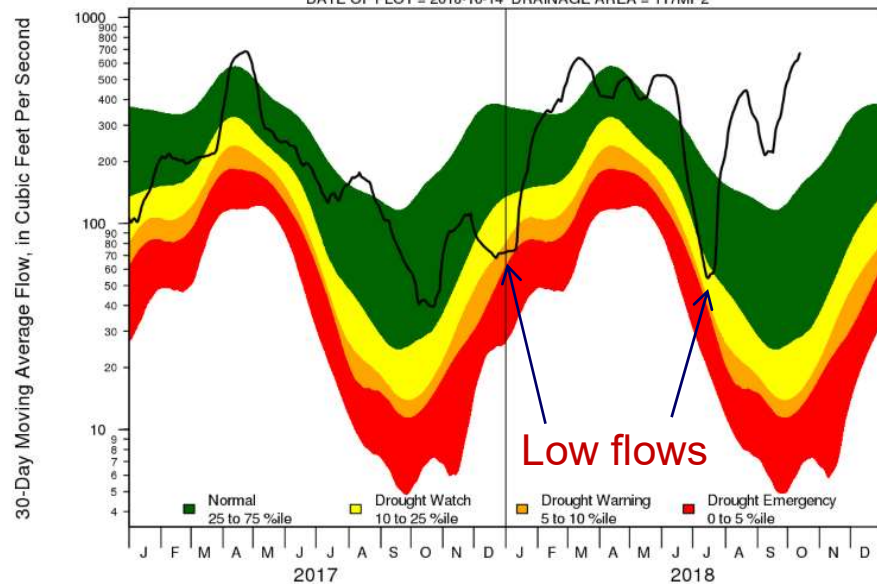
January and July 2018 levels were low (<10<sup>th</sup> percentile) in well PI-590 and several other wells in Pike County

# Example of relation between streamflow and groundwater levels – low flows January and July 2018

Site Sta

01439500 - BUSH KILL AT SHOEMAKERS, PA

PROVISIONAL DATA - SUBJECT TO CHANGE  
RECORD START = 1908-10-01 NUMBER OF YEARS = 109  
DATE OF PLOT = 2018-10-14 DRAINAGE AREA = 117MI<sup>2</sup>



[Link to Real-Time Data](#) (opens in new window)

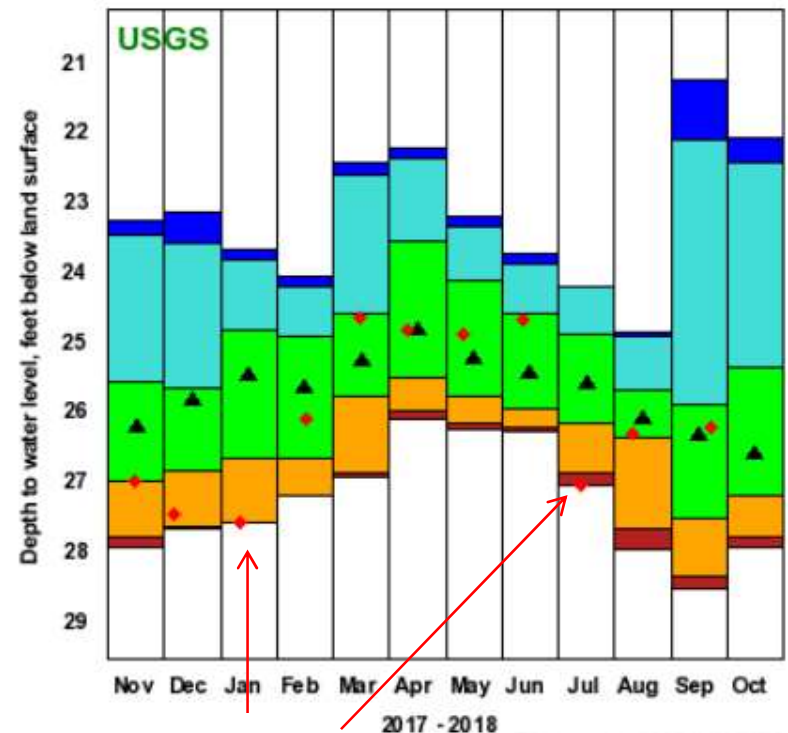
[Table of ice-affected surface water sites](#)

ALL DATA SHOWN ARE BASED ON 30-DAY MOVING AVERAGES; PERCENTILE BANDS HAVE BEEN SMOOTHED.

SOLID LINE = 30-DAY MOVING AVERAGE OF CURRENT DAILY VALUE FLOW

GREEN (TOP) BAND = 25- TO 75-PERCENTILE FLOWS (NORMAL CONDITIONS)  
YELLOW BAND = 10- TO 25-PERCENTILE FLOWS (DROUGHT WATCH CONDITIONS)  
ORANGE BAND = 5- TO 10-PERCENTILE FLOWS (DROUGHT WARNING CONDITIONS)  
RED (BOTTOM) BAND = 0- TO 5-PERCENTILE FLOWS (DROUGHT EMERGENCY CONDITIONS)

410537075000801 - PI 590



Plot created 10/13/18 07:17

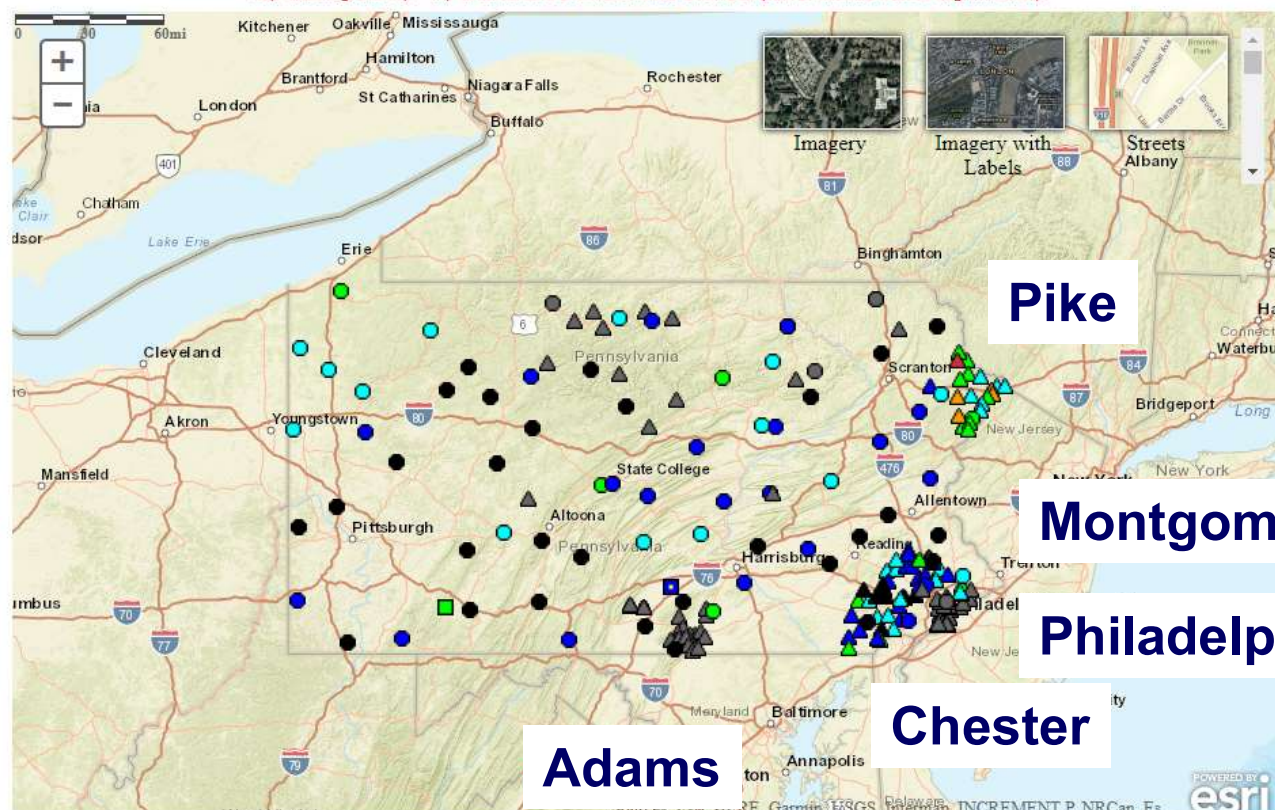
Explanation - Percentile Classes

◆ Data Point  
● < 10 ● 10 - 24 ● 25 - 75 ● 76 - 90 ● > 90  
▲ Monthly Median



## Pennsylvania Active Water Level Network

Click site symbol to open information pop-up. Click Station ID in pop-up for county information and site selection.  
Map loading slowly? Try a different browser. Web browser performance varies significantly.



Explanation - Percentile classes (symbol color based on most recent measurement)						Wells		Springs	
<span style="color: red;">●</span>	<span style="color: red;">●</span>	<span style="color: orange;">●</span>	<span style="color: green;">●</span>	<span style="color: cyan;">●</span>	<span style="color: blue;">●</span>	<span style="color: black;">●</span>	<input type="checkbox"/> Real-Time	<input type="checkbox"/> Continuous	<input type="checkbox"/> Periodic Measurements
Low	<10 Much Below Normal	10-24 Below Normal	25-75 Normal	76-90 Above Normal	>90 Much Above Normal	High	<input type="checkbox"/> Not Ranked		

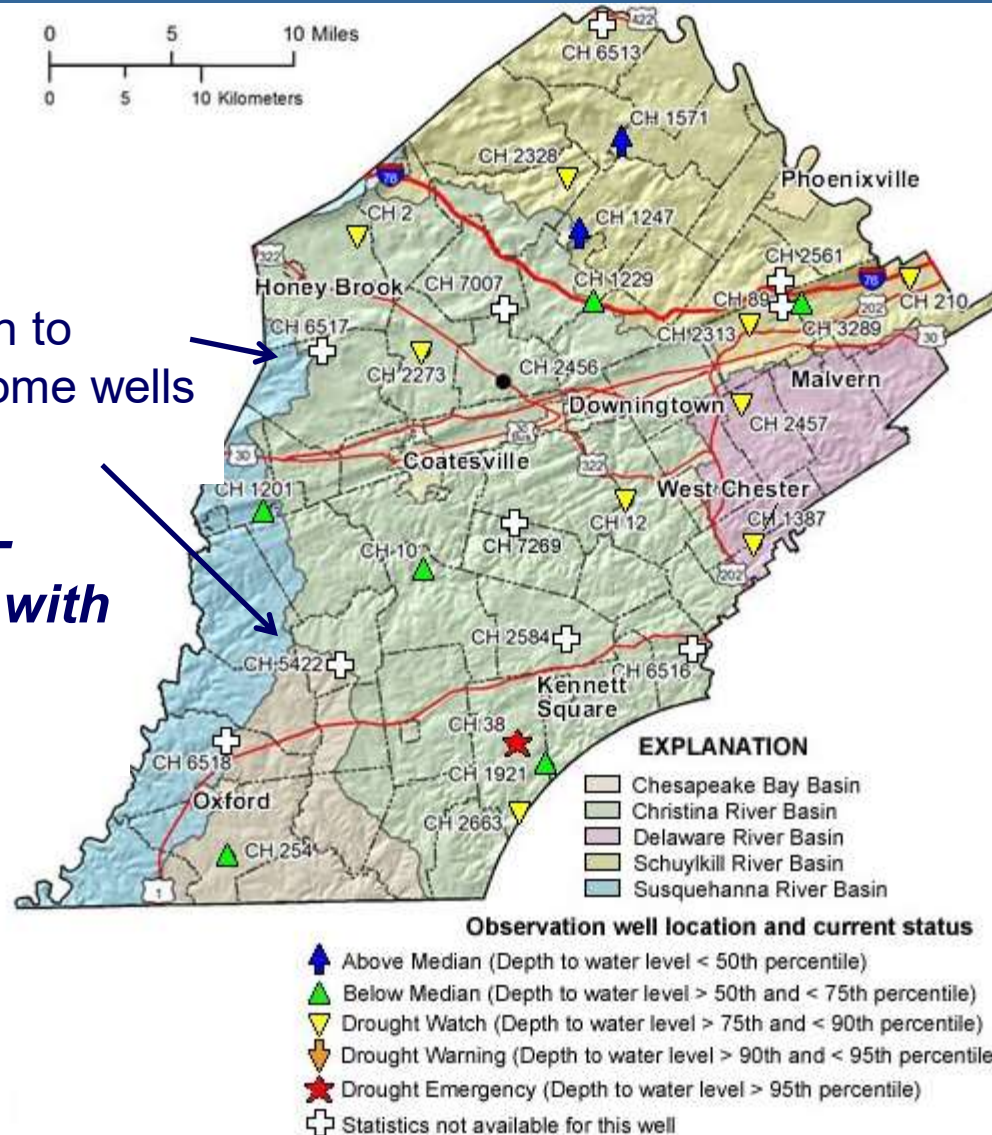
Map generated 10/11/2018 10:38:03 AM

# Chester County Observation Well Network – Drought Status

[http://pa.water.usgs.gov/projects/assessments/chesco/ground\\_water.php](http://pa.water.usgs.gov/projects/assessments/chesco/ground_water.php)

(Record not long enough to calculate statistics for some wells  
In 2012)

**Example of ground-  
water level network with  
20 or more years of  
data for most wells**



# USGS web links to water-level data

## <http://groundwaterwatch.usgs.gov>

Pennsylvania

<http://groundwaterwatch.usgs.gov/StateMap.asp?sa=PA&sc=42>

Pike County

<http://groundwaterwatch.usgs.gov/countymap.asp?sa=PA&cc=103>